

1. A slanted hologram made by exposing an interference pattern inside a polymer-dispersed liquid crystal material, the polymer-dispersed liquid crystal material comprising, before exposure:

- 5                   (a) a polymerizable monomer;
- (b) a liquid crystal;
- (c) a cross-linking monomer;
- (d) a coinitiator; and
- (e) a photoinitiator dye;

10                   wherein the hologram has opposing surfaces and a plurality of polymer regions having a first refractive index and polymer-dispersed liquid crystal regions having a second refractive index disposed at an angle to the opposing surfaces of the hologram whereby the  
15                   symmetry axis of the liquid crystal is disposed at an angle to the opposing surfaces of the hologram.

2       The slanted hologram of claim 1, wherein the polymerizable monomer comprises dipentaerythritol hydroxypentaacrylate.

3. The slanted hologram of claim 1, wherein the polymer-dispersed liquid crystal material further comprises, before exposure, a surfactant.

4. The slanted hologram of claim 1, wherein:

(a) the liquid crystal comprises 10-40% by total weight of the polymer-dispersed liquid crystal material;

5 (b) the cross-linking monomer comprises 5-15% by total weight of the polymer-dispersed liquid crystal material;

(c) the amount of coinitiator is  $10^{-3}$  to  $10^{-4}$  gram moles; and

10 (d) the amount of photoinitiator dye is  $10^{-5}$  to  $10^{-6}$  gram moles.

5. The slanted hologram of claim 1, wherein:

(a) the liquid crystal comprises 10-40% by total weight of the polymer-dispersed liquid crystal material;

5 (b) the cross-linking monomer comprises 10-18% by total weight of the polymer-dispersed liquid crystal material;

(c) the coinitiator comprises 2-3% by total weight of the polymer-dispersed liquid crystal material; and

10 (d) the photoinitiator dye comprises 0.2-0.4% by total weight of the polymer-dispersed liquid crystal material.

6. The slanted hologram of claim 2, wherein the surfactant comprises about 6% by total weight of the polymer-dispersed liquid crystal material.

7. The slanted hologram of claim 2, wherein the surfactant comprises about 5-10% by total weight of the polymer-dispersed liquid crystal material.

8. The slanted hologram of claim 2, wherein the liquid crystal includes a mixture of cyano biphenyls.

9. The slanted hologram of claim 1, wherein the cross-linking monomer comprises N-vinylpyrrolidone.

10. The slanted hologram of claim 1, wherein the coinitiator comprises N-phenylglycine.

11. The slanted hologram of claim 1, wherein the photoinitiator dye comprises rose bengal ester.

12. The slanted hologram of claim 3, wherein the surfactant comprises octanoic acid.

13. The slanted hologram of claim 4, wherein the polymer-dispersed liquid crystal material further comprises, before exposure, a surfactant.

14. The slanted hologram of claim 5, wherein the polymer-dispersed liquid crystal material further comprises, before exposure, a surfactant.

15. The slanted hologram of claim 4, wherein the polymerizable monomer comprises dipentarythritol hydroxypentaacrylate.

16. The slanted hologram of claim 5,  
wherein the polymerizable monomer comprises  
dipentarythritol hydroxypentaacrylate.

17. A slanted hologram made by exposing an  
interference pattern inside a polymer-dispersed  
liquid crystal material, the polymer-dispersed  
liquid crystal material comprising, before  
5 exposure:

- (a) a polymerizable monomer;
- (b) a liquid crystal;
- (c) a cross-linking monomer;
- (d) a coinitiator; and
- 10 (e) a photoinitiator dye;

wherein the hologram has opposing surfaces  
and a plurality of alternative planes of polymer  
channels having a first refractive index and  
polymer-dispersed liquid crystal channels having  
15 a second refractive index disposed at an angle  
to the opposing surfaces of the hologram whereby  
the symmetry axis of the liquid crystal is  
disposed at an angle to the opposing surfaces of  
the hologram.

18. The slanted hologram of claim 17,  
wherein the polymerizable monomer comprises  
dipentarythritol hydroxypentaacrylate.

19. The slanted hologram of claim 17,  
wherein the polymer-dispersed liquid crystal  
material further comprises, before exposure, a  
surfactant.

20. The slanted hologram of claim 17,  
wherein:

- 5 (a) the liquid crystal comprises 10-40% by total weight of the polymer-dispersed liquid crystal material;
- (b) the cross-linking monomer comprises 5-15% by total weight of the polymer-dispersed liquid crystal material;
- 10 (c) the amount of coinitiator is  $10^{-3}$  to  $10^{-4}$  gram moles; and
- (d) the amount of photoinitiator dye is  $10^{-5}$  to  $10^{-6}$  gram moles.

21. The slanted hologram of claim 17,  
wherein:

- 5 (a) the liquid crystal comprises 10-40% by total weight of the polymer-dispersed liquid crystal material;
- (b) the cross-linking monomer comprises 10-18% by total weight of the polymer-dispersed liquid crystal material;
- 10 (c) the coinitiator comprises 2-3% by total weight of the polymer-dispersed liquid crystal material; and
- (d) the photoinitiator dye comprises 0.2-0.4% by total weight of the polymer-dispersed liquid crystal material.

22. The slanted hologram of claim 18,  
wherein the surfactant comprises about 6% by total weight of the polymer-dispersed liquid crystal material.

23. The slanted hologram of claim 18, wherein the surfactant comprises about 5-10% by total weight of the polymer-dispersed liquid crystal material.

24. The slanted hologram of claim 18, wherein the liquid crystal includes a mixture of cyano biphenyls.

25. The slanted hologram of claim 17, wherein the cross linking monomer comprises N-vinylpyrrolidone.

26. The slanted hologram of claim 17, wherein the coinitiator comprises N-phenylglycine.

27. The slanted hologram of claim 17, wherein the photoinitiator dye comprises rose bengal ester.

28. The slanted hologram of claim 19, wherein the surfactant comprises octanoic acid.

29. The slanted hologram of claim 20, wherein the polymer-dispersed liquid crystal material further comprises, before exposure, a surfactant.

30. The slanted hologram of claim 21, wherein the polymer-dispersed liquid crystal material further comprises, before exposure, a surfactant.

31. The slanted hologram of claim 20, wherein the polymerizable monomer comprises dipentarythritol hydroxypentaacrylate.

32. The slanted hologram of claim 21, wherein the polymerizable monomer comprises dipentarythritol hydroxypentaacrylate.

33. A static hologram made by exposing an interference pattern inside a polymer-dispersed liquid crystal material, the polymer-dispersed liquid crystal material comprising, before exposure:

- (a) a polymerizable monomer;
- (b) a liquid crystal;
- (c) a cross-linking monomer;
- (d) a coinitiator; and
- (e) a photoinitiator dye;

wherein the hologram has a plurality of polymer regions having a first refractive index and polymer-dispersed liquid crystal regions having a second refractive index wherein at least a portion of the liquid crystal in the polymer-dispersed liquid crystal regions has been removed.

34. A static hologram made by exposing an interference pattern inside a polymer-dispersed liquid crystal material, the polymer-dispersed liquid crystal material comprising, before exposure:

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- (a) a polymerizable monomer;
- (b) a liquid crystal;
- (c) a cross-linking monomer;
- (d) a coinitiator; and
- (e) a photoinitiator dye;

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wherein the hologram has a plurality of alternating planes of polymer channels having a first refractive index and polymer-dispersed liquid crystal channels having a second refractive index wherein at least a portion of the liquid crystal in the polymer-dispersed liquid crystal channels has been removed.

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35. A method for preparing static hologram, comprising:

disposing a polymer-dispersed liquid crystal material between transparent plates;

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exposing an interference pattern inside the polymer-dispersed liquid crystal material thereby forming a hologram having polymer regions having a first refractive index and polymer-dispersed liquid crystal regions having a second refractive index; and

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removing at least a portion of the liquid crystal in the polymer-dispersed liquid crystal channels.



36. A method for preparing a static hologram, comprising:

disposing a polymer-dispersed liquid crystal material between transparent plates;

5 exposing an interference pattern inside the polymerdispersed liquid crystal material thereby forming a hologram having alternating planes of polymer channels having a first refractive index and polymer-dispersed liquid crystal channels  
10 having a second refractive index; and

removing at least a portion of the liquid crystal in the polymer-dispersed liquid crystal channels.

37. The method of claims 35 or 36, wherein a portion of the liquid crystal in the polymer-dispersed liquid crystal channels is removed by disposing the hologram in a solvent.